“This Is Why We Can’t Have Nice Things”

A Project Risk Retrospective

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Abstract

My advisor and I reviewed twelve major projects that collectively spanned a 4500-year period. Our project sample ranged from the Giza Pyramid to the Panama Canal. With the information contained within Mark Kozak-Holland’s text, *The History of Project Management*, we performed 103 qualitative risk assessments. Frederick Brooks’ book, *The Mythical Man Month* served as a supporting work for our analysis. Empirical and speculative study of our risk assessments suggests that a project’s risk management maturity may be a product of both cultural and environmental factors. Specifically, we identified a possible inverse relationship between risk management rigor and environmental adversity and a possible direct relationship between risk management rigor and cultural sophistication. Understanding these phenomena may help modern project management practitioners better manage risks to their projects.

Keywords: project management, historical projects, risk management maturity

Introduction

Background

In the autumn of 2011, my advisor and I sat down to explore two books, *The History of Project Management* by Mark Kozak-Holland and *The Mythical Man Month* by Frederick Brooks. Our purpose was twofold. First, we wanted to compare and contrast the two texts, as the former was brand new and the latter was well established in the project management community. Second, Kozak-Holland’s book was a massive compilation of historical project information, covering major projects from the Giza Pyramid to the Panama Canal. For the first

time, an author specifically placed our collective knowledge of these endeavours under the project management lens. We sought to uncover trends in his research that might lend valuable insight into modern project management practices.

During the course of our analysis we made some interesting discoveries of our own. This paper steps through our approach to the material and presents our findings, along with both our empirical and speculative conclusions.

Brooks’ Law

Frederick Brooks’ text, *The Mythical Man Month,* has been a staple in project management libraries since its original publication in 1975. Although his primary focus is software engineering, Brooks is probably best known for his theories on project communications. He believes that project complexity is a product of the number of people involved in a project.

Brooks notes that as people join a team, the number of individual communication paths increase by an exponential, rather than a linear curve (see Figure 1). If the work individuals perform results in knowledge they need to share with the rest of the project team, they will need to ensure they route this new information along every one of the paths available to them. Failure to do so may result in other people performing their work based on obsolete information.

Figure 1. Project Complexity As Measured By Interpersonal Connections

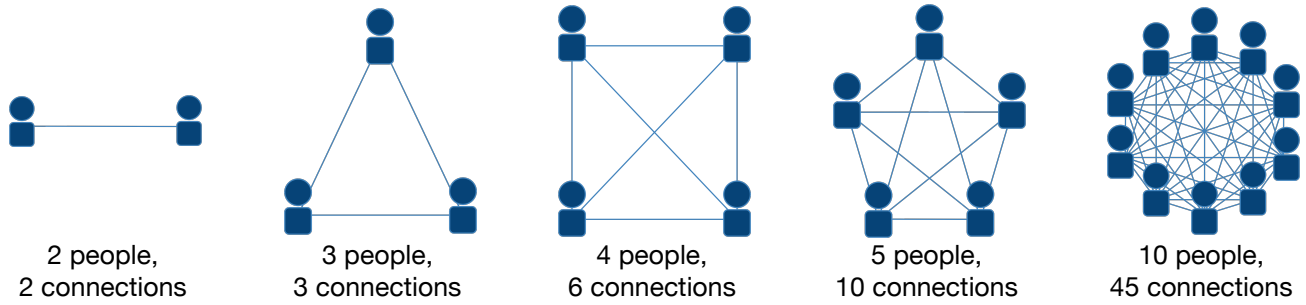

Figure 1. Using the formula $\frac{n \times (n-1)}{2}$, one can quickly determine how many communication paths exist among project teams of any size. Developed from a formula in *The Mythical Man Month* by Frederick P. Brooks, Jr. (1995), p. 18.

Project managers need to understand this phenomenon and accordingly manage communications. The problem, according to Brooks, is that information streaks down these paths all the time. Team members’ knowledge of a project grows the longer they are exposed to the associated work. New team members will not have this context and must come fully up to speed, while new information speeds along channels around them that they are not yet prepared to understand. And so Brooks postulated Brooks’ Law: “Adding people to a late project makes the project later” (Brooks, 1995).

Project Management Fundamentals

Frederick Brooks’ insights did not grow in a vacuum. Various agencies around the world have devoted tremendous resources towards the development of project management education programs. One such company is the Project Management Institute (PMI) based in the United States. At the core of their methodology lie five process groups and nine knowledge areas.

The PMI’s process groups take a very particular shape. Projects begin with an initiating phase, where the project manager works with key stakeholders to establish ground rules and identify a project’s purpose, objectives and scope. When those details have been ironed out,

the project enters a planning phase. Here, the project manager plans out, in as much detail as may be determined with the information available, the work required to deliver the project's scope. Next, the project team begins to execute the plan. Likely, new information will surface that causes the project manager to replan and resulting plan revisions would inform further project execution. During the cycle of plan/execute/replan, a fourth process group concerned with monitoring and controlling the project governs ongoing work. Here, good project governance takes center stage. Finally, when the project team has met the objectives specified during the initiating processes, the project manager takes active steps to close out the project, shut down all work and hand the finished product over to the stakeholders. The PMI's process groups are shown in Figure 2.

Figure 2. Project Management Process Groups

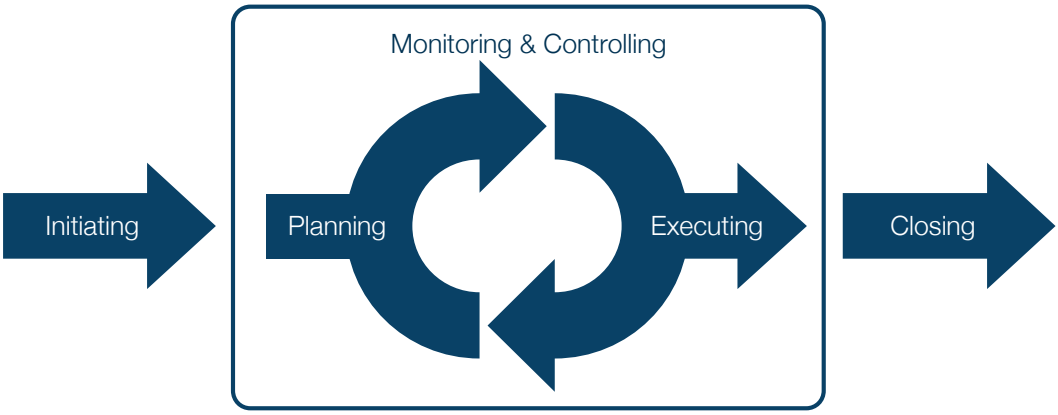

Figure 2. The Project Management Institute specifies five discrete process groups, which every well-managed project should incorporate. Adapted from *A Guide to the Project Management Body of Knowledge, 4th Edition* by the Project Management Institute (2008), p. 19.

The nine knowledge areas are every bit as important as the aforementioned process groups. Here, the PMI has identified specific tools and techniques that a project manager must master in order to deliver their projects on time, on budget and on scope. The integration knowledge area covers management techniques associated with the highest level of project management. Successful integration management allows the whole project to hang together as a unit. Scope management, time management and cost management each are

associated with one aspect of a project's "triple constraint". This means, that of a project's scope, schedule or budget, the project manager cannot change one without also changing the other two. Further knowledge areas cover aspects of a project such as quality, human resources, communications, risk and procurement (PMI, 2008).

The intersection of the process groups and knowledge areas comprises the heart of the PMI's body of knowledge and is shown in Table 1. Mastery of this table is critical for any project manager wishing to earn his or her accreditation. Indeed, the author of *The History of Project Management* used this very table as a template through which to deliver his findings.

Table 1. Page 43 of the Project Management Body of Knowledge

Knowledge Areas	Project Management Process Groups				
	Initiating	**Planning**	**Executing**	**Monitoring & Controlling**	**Closing**
Integration Management	• Develop Project Charter	• Develop Project Management Plan	• Direct / Manage Execution	• Monitor and Control Work • Perform Change Control	• Close Phase or Project
Scope Management		• Collect Requirements • Define Scope • Create WBS		• Verify Scope • Control Scope	
Time Management		• Define Activities • Sequence Activities • Estimate Activity Resources • Estimate Activity Durations • Develop Schedule		• Control Schedule	
Cost Management		• Estimate Costs • Determine Budget		• Control Costs	
Quality Management		• Plan Quality	• Perform Quality Assurance	• Perform Quality Control	
Human Resources Management		• Develop Human Resources Plan	• Acquire Project Team • Develop Project Team • Manage Project Team		
Communications Management	• Identify Stakeholders	• Plan Communications	• Distribute Information • Manage Stakeholders	• Report Performance	
Risk Management		• Plan Risk Management • Identify Risks • Perform Qualitative Risk Analysis • Perform Quantitative Risk Analysis • Plan Risk Responses		• Monitor and Control Risks	
Procurement Management		• Plan Procurements	• Conduct Procurements	• Administer Procurements	• Close Procurements

Table 1. The intersection of process groups and knowledge areas forms the basis for modern project management practices. Cells in the above grid contain a collection of tools and techniques that project managers must master in order to achieve Project Management Professional status from the Project Management Institute. Adapted from *A Guide to the Project Management Body of Knowledge, 4th Edition* by the Project Management Institute (2008), p. 43.

Method

Kozak-Holland’s book was a treasure trove of good project management data. When we began our research, however, we were uncertain what to expect. The journey could take us anywhere, but if we began our analysis without a tracking plan, we stood to lose valuable insights. Before we got too far into the material, therefore, we selected and mapped out those projects that we would include in our sample. Figure 3 plots these works on a timeline in chronological order.

Figure 3. Timeline of Major Projects Covered in *The History of Project Management*

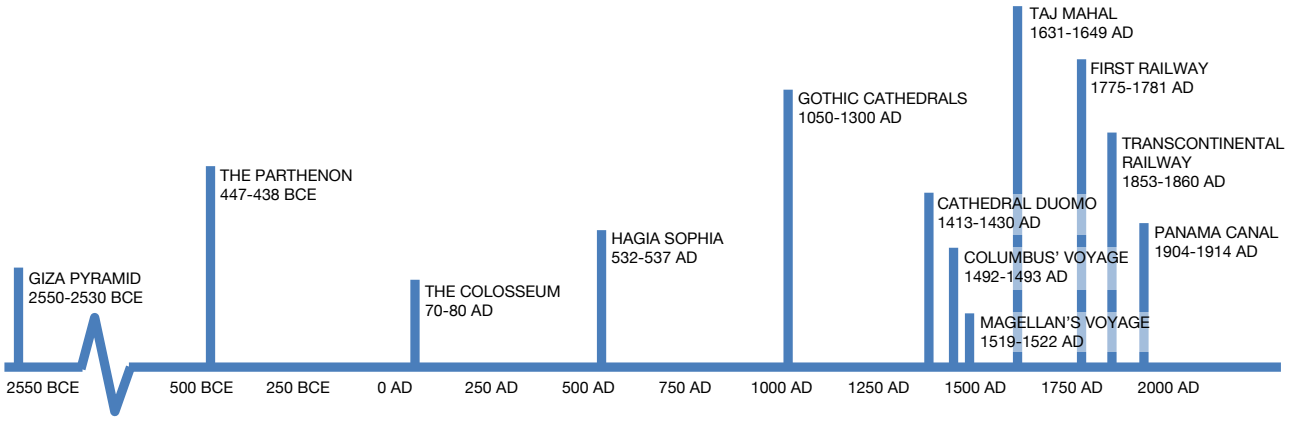

Figure 3. Chronological timeline of selected projects we used in our research. We chose those projects that contained the greatest amount of detail within the text to better perform our analysis. Adapted from *Project Management in History* by Mark Kozak-Holland (2011).

We initially approached the text with the intention of capturing lessons learned from each major project. Using the aforementioned PMBoK page 43, we developed a checklist and sought to identify whether or not the project managers in question performed certain standard high-level processes. We expected to identify problems that resulted from adherence failure. However, we quickly discovered that the text was entirely bound by the historical record; therefore, much of this information was not available. Furthermore, the exercise was highly subjective. If, for example, a project manager had stakeholder difficulty, how might one

determine whether or not stakeholder management lessons were learned, if the overall project was successfully completed? Eschewing this line of study, we moved on.

We then sought to identify whether or not the historical record suggests that project managers gleaned new pieces of insight from their projects as a result of having completed them. We defined a “lesson learned” as new knowledge that emerged during the course of a project that did not exist before, or of which the project team had previously been unaware. We did manage to identify a few of these. For example, stakeholders involved in the Hagia Sophia project wanted a circular dome on top of the cathedral. As the project unfolded, however, the project team discovered that a circular dome was not physically possible using the technology at their disposal. The stakeholders changed their requirements—the project team built an elliptical dome instead. Unfortunately we were unable to identify more than a small handful of points like this as we conducted our analysis. While interesting, we decided to abandon this line of research since we could not develop any meaningful constructs.

Leaving the concepts of “lessons learned” behind, we changed our approach and moved onwards to risk analysis. We performed 103 qualitative risk assessments on risk events we identified within the text. Since we recognized that a qualitative risk assessment is by nature highly subjective and that history may already be subject to interpretation, we sought to maximize objectivity during our analysis. First, we set the following criteria for including a risk in the assessment:

1) The text had to explicitly mention a risk event.
2) The text had to explicitly state the consequence of the risk event.
3) The text had to clearly articulate the approach and strategy the project manager in question used to address the risk event.

We subjectively rated the likelihood of each risk event both before and after the project manager selected their risk approach (one of four: avoid, transfer, mitigate, accept). Likelihood ratings fell on a scale from 1 to 4 where 1 represented “unlikely” and 4 represented “highly likely”. We then subjectively rated the impact of each risk event on the project both before and after the risk approach. Impact ratings fell on a scale from 1 to 4 where 1 represented “minimal impact” and 4 represented “catastrophic impact”. We used the formula [*Likelihood Rating* + 1] x [*Impact Rating* + 1] to obtain a risk score for each risk event both before and after the risk approach. The following table shows how we arrived at our ultimate risk rating.

If an event’s risk score fell between…			**…then we rated the risk…**
0	and	9	Benign
10	and	15	Watch
16	and	20	Serious
21	and	25	Ruinous

All qualitative risk assessments are included in Appendix A. We expected that for each case, the risk score before the project manager selected their risk management approach should be higher than the risk score after the project manager applied their risk management approach. Our results validated this hypothesis; however, the pattern that emerged from our data was unexpected.

Results

One-by-one we completed our risk assessments. A pattern began to take shape from the very beginning that we were pleasantly surprised to watch unfold. Starting with the Giza Pyramid construction in 2550 BCE, the differences in project risk levels before and after

mitigation steadily narrowed until Magellan's Voyage in 1519, at which point these differences began to widen again. From that fateful expedition, the risk level delta continued to widen until 1904 (the time of the second Panama Canal attempt), at which time the delta was greater than ever before. We present the results of this analysis in Figure 4.

Figure 4. Changes in Risk Levels Before and After Mitigation

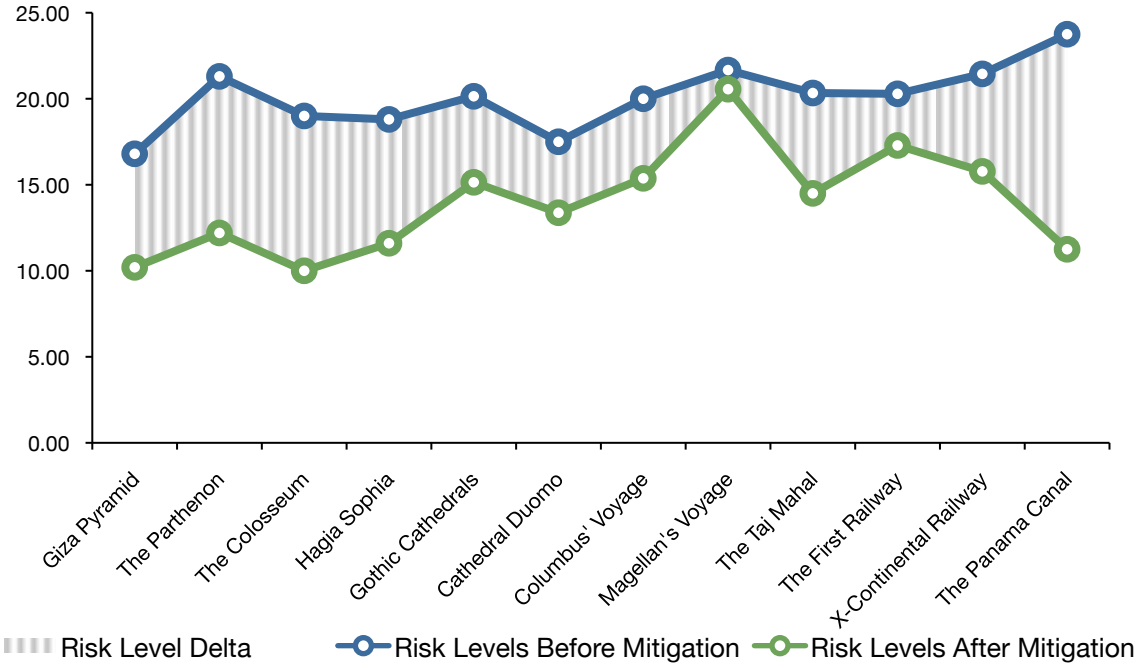

Figure 4. Qualitative risk analysis performed across twelve separate projects documented within *The History of Project Management* yielded a pattern. The level of risk management maturity appeared to diminish over time until Magellan's Voyage, at which point it began to radically improve, to higher levels than previously seen.

We interpreted this risk level delta as an indicator of project risk management maturity. That is, a large difference in risk levels before and after mitigation suggested that the project manager took mature steps to try to minimize the risk to their project. Conversely, a small difference in risk levels before and after mitigation suggested that the project manager took very few steps to address project risk.

As this trend appeared over the course of the text analysis, we became very interested in what was happening to show such a clear picture. Before we dove into causal analysis, we

sought to identify the actual numbers behind the risk level delta. We calculated the percentage improvement from baseline after risk mitigation and plotted these numbers on a graph (as shown in Figure 5). This chart formed the reference point for all subsequent study.

Figure 5. Percentage Improvement in Risk Levels

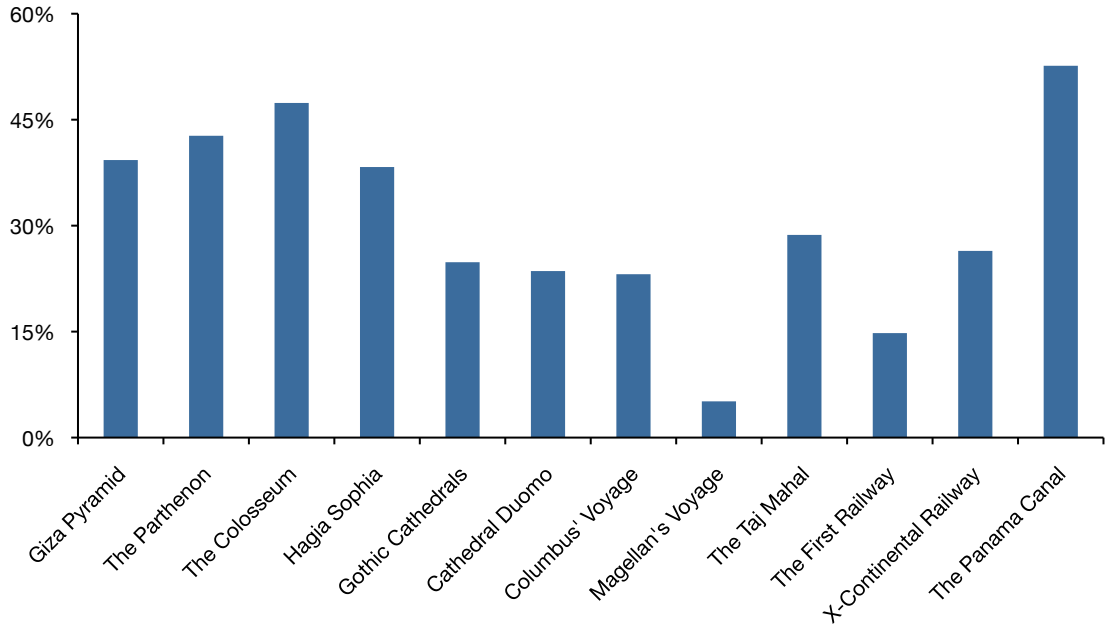

Figure 5. This graph represents the delta between the risk levels before and after mitigation (as shown in Figure 4). Risk management maturity appears to generally diminish over time until Magellan's Voyage and then substantially improve by the time of the second Panama Canal attempt.

Further Analysis

Curious about the trend our analysis revealed, we returned to the original project timeline to try and better understand our results. We felt that a review of large-scale environmental conditions might shed some light on this new information. We discovered three catastrophic events within the text: they were, in order, the Fall of the Roman Empire (approximately 395-476 AD), the Black Death's devastation of Europe (approximately 1346-1353 AD) and the glacial advancement over Europe commonly known as The Little Ice Age (dates uncertain, but roughly from 1500-1850 AD) (Kozak-Holland, 2011). We then plotted

these events against our high level timeline to see what coincidences we might find. Figure 6 shows the results of this analysis.

Figure 6. Project Alignment with Catastrophic World Events

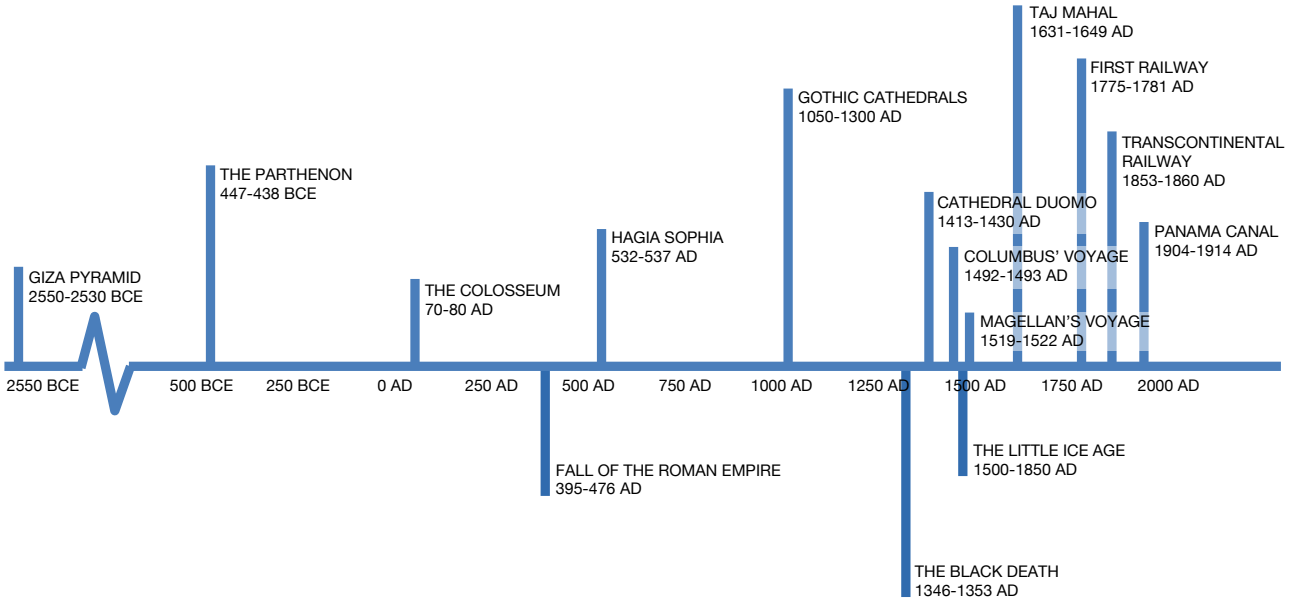

Figure 6. Returning to the original timeline for all projects under review, this figure juxtaposes major catastrophic events that may have helped shape the environments of concomitant projects.

The Fall of the Roman Empire was certainly a major event. The loss of this seat of enlightenment plunged all of Europe into the Dark Ages for several hundred years. We did not, however, have sufficient project data to align therewith. Indeed, the nearest works we could identify were the construction of the Roman Colosseum (70-80 AD) and the erection of Hagia Sophia in Constantinople (532-537 AD). Therefore, we could not draw any meaningful inferences from the position of the Empire’s collapse on the timeline. Projects concurrent with the Black Death and Little Ice Age were a different story. A wealth of project information coincided with these catastrophic events and we were able to form a picture of project environments during this period. Approaching our data from this angle, we decided to take a closer look at the high and low points of our graph.

Risk Maturity Nadir: Magellan’s Voyage Around the World

According to the Project Management Institute, the first step in any project should be the development of a Project Charter (see Table 1). The charter document outlines a project’s purpose, objectives and scope and should help anyone who reads the document understand the project’s background. Looking back on any successful project, one can easily determine scope. Objectives are generally not difficult to discern, either. After all, if a project was successful, it should have, by definition, realized its objectives. A project’s purpose, however, is not always clear. In order to reconstruct a project’s charter, we must understand the purpose behind the project.

Such was the case with the lowest point on our risk maturity analysis: Magellan’s circumnavigation of the globe. The journey itself was the project scope. We may assume that the bounty of spices and discovery of new lands with which the voyage returned comprised the project’s objectives. To understand the purpose behind the project, however, we need to look deeper into what was happening in Europe before the expedition.

Two hundred years earlier, the Black Death ravaged Europe (Kozak-Holland, 2011). Viewed by many as a divine form of punishment, the actual cause was more mundane. A disease known as the bubonic plague cut a swath through civilizations in Asia. The expansionist Mongols of the Far East had already seen how effectively this disease exterminated their own people. When they lay siege to the Ukrainian city of Caffa, they flung their own plague-ridden dead over the city walls in the world’s first documented case of biological warfare (Campbell, 2009). From there, rats carrying the disease boarded ships bound for other European destinations. Within a few short years, the bubonic plague obliterated between 30 and 60 percent of Europe’s population (see Figure 7).

Figure 7. The Course of the Black Death in 14th Century Europe

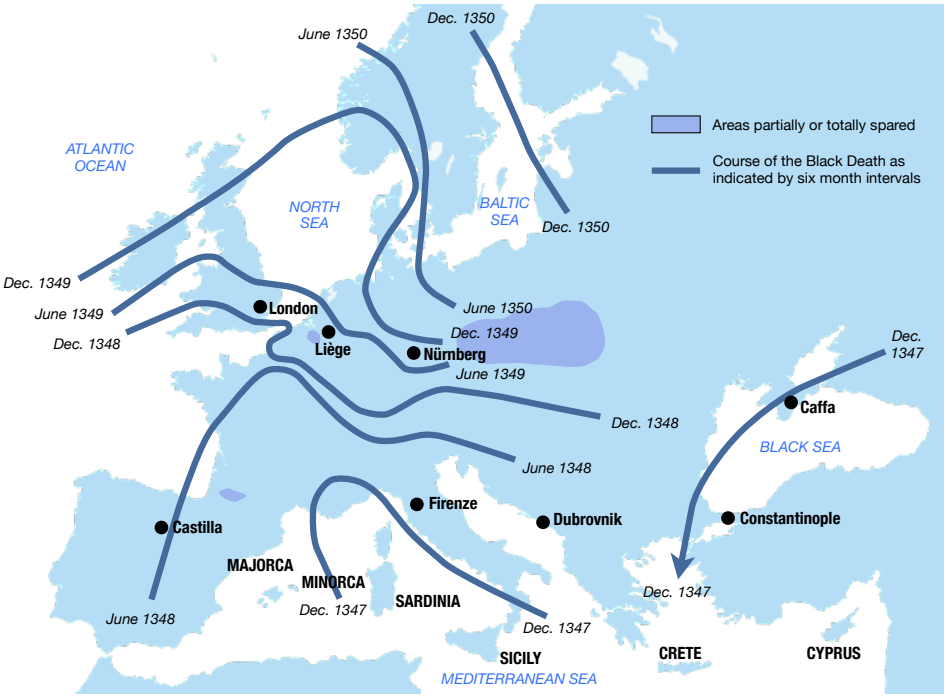

Figure 7. Beginning with the Mongol siege at Caffa, the bubonic plague rapidly spread through Europe, decimating the population and creating a dearth of labour for future projects. Adapted from a graphic in “The History Guide” by Steven Kreis. Retrieved on December 23, 2011 from http://www.historyguide.org/ancient/bdmap.html.

Although the Black Death preceded Magellan’s voyage by some two hundred years, the pandemic’s legacy resulted in more than just a catastrophic death toll. The surviving working class suddenly became very, very expensive. This labour shortage put a tremendous strain on European economies and considerable pressure on the ruling classes to find a solution (Campbell, 2009).

The Little Ice Age was another important factor. We do not have exact dates for when the glacial advancement began, but winter paintings started to appear across Europe in the early 1500s (Kozak-Holland, 2009). We may surmise that temperatures had fallen significantly by the time of Magellan’s voyage. While the moniker “The Little Ice Age” sounds somewhat benign, its impact on European culture was severe. Colder temperatures resulted in failing crops and destruction of food stores. Livestock perished and people had to find new means

to keep warm. As local, viable resources began to diminish, Europe had to look outside its borders for new resources that might ensure its continued survival. By the time of the Little Ice Age, the continent had established trade routes with the Far East who could provide the desperate Europeans with the goods they required. Whoever controlled these routes controlled the economy.

Christopher Columbus’ discovery of America twenty years earlier was a third important factor (Kozak-Holland, 2011). Europe was still dealing with a shortage of expensive labour brought about by losses due to the bubonic plague and was beginning to deal with a shortage of resources brought about by withering crops and freezing conditions associated with glacial advancement. Columbus’ return provided a possible solution. New lands and rich resources lay beyond the horizon…for anyone with the means and ability to get there. Spain was the primary stakeholder involved in both the Columbus and Magellan expeditions. Upon Columbus’ return the Spanish royalty figured out pretty quickly that these newly discovered lands were not Asian. Portugal already controlled African trade routes to the Far East; if Spain wanted to partake in the spoils, they still needed to find another way to Asia.

Circumnavigation of the globe, however, was an incredibly risky venture. Nobody knew the way, or the perils that awaited an expedition with that destination. The distance involved in global transversal was another unknown factor. Even if the voyage was successful, there was no means to estimate how long it would take. From a risk / reward perspective, the sensible choice was to forget the trip and make do with existing resources.

To do so, however, would be to watch neighbouring Portugal grow in power and possibly engulf Spain, whose own resources were struggling. In the face of such conditions, Spain made an insane choice: they backed Magellan’s journey.

From a risk management perspective, Spain’s decision seems foolish. Why would an organization struggling to maintain it’s seat in the face of dwindling resources and expensive labour, put massive amounts of resources towards a project whose outcome was so uncertain? Desperation seems like the most likely answer. Under these conditions, the risks were irrelevant. From Spain’s perspective, taking no action might well have resulted in its own demise.

With the stage set and the stakeholders endorsing the project, Magellan and his crew set sail to find a passage through the Americas. When they left Spain, the expedition included five ships and high hopes. As they reached the South American coastline, however, the fabled passage eluded them. Magellan commanded his ships down inlet after inlet, each time increasing his men’s anxiety as inlets proved to lead nowhere. Here, Magellan had a choice. He could admit to his crew that he was uncertain where to go and ask for their indulgence and cooperation. These were seasoned men under his charge. With the right approach, they would have understood.

Instead, Magellan killed all who questioned him.

His behaviour here severely damaged the morale of his men. Not only was the crew afraid and uncertain since they did not know where they were, but their commander was also a madman. One by one, men fled the expedition. Some mutinied and some tried to kill Magellan or seize control. Others simply recruited frightened men and stole away with one of the ships. The expedition eventually found its passage around the tip of South America, but not without having suffered heavy casualties. Of the five ships that had left Spain, only one made the voyage home (Kozak-Holland, 2011).

Looking at Magellan's leadership from a critical perspective, we can easily condemn him and say, "That's bad management". Most of us consider the murder of one's staff for asking reasonable questions to be somewhat inappropriate behaviour. But what in particular is wrong with this style of leadership from a risk management perspective?

The Project Management Institute suggests project managers have very explicit roles where it comes to managing project risk (see Table 2). A project manager is not meant to set the risk tolerance of a project, but only to keep stakeholders informed, such that they can make good risk decisions.

Table 2. Project Risk Management Roles and Responsibilities

Sponsor / Stakeholder (Spanish Royalty)	Project Manager (Magellan)
Sets objectives	Develops and executes plan
Sets risk tolerance	Manages to tolerance threshold
Accepts consequences	Monitors risk
Earns rewards	Delivers results

Table 2. Differences in roles and responsibilities between project stakeholders and project managers, as applied to the Magellan expedition.

At the onset of the project, the Spanish royalty would have established their objectives (i.e., the expedition should return home with new lands and spoils) and thereby set their risk tolerance level (i.e., the expedition should not suffer unnecessary harm that jeopardizes said objectives). Thousands of miles away, out of their watchful eye, the stakeholders had to trust Magellan to manage the project to the risk thresholds they had established. As the expedition left port in Spain, the Spanish royalty owned the risks associated with their project. When Magellan failed to adequately prepare and manage his men's fears, however, he subverted risk ownership and made it his own.

Unfortunately for the project, when Magellan took over risk ownership, he also changed the project's objectives. The expedition was no longer about making the trip home

with new lands and spoils—that was now a secondary objective. The project’s primary objective had become the maintenance of autocratic control. This may seem like a subtle distinction, but this fundamental shift to the project may well be the reason that four of the five ships failed to return home.

Our review of the Magellan case study suggests the following three factors that led to such a low project risk management maturity level.

1) Expensive labour resulting from the Black Death and a shortage of resources resulting from the Little Ice Age put Spain in a difficult position given that rival Portugal controlled Asian trade routes. In other words, desperate times called for desperate measures.

2) Magellan’s pride and violent responses to questions of his authority irrevocably damaged the confidence of his project team.

3) Intentionally or otherwise, Magellan’s poor leadership effectively wrested ownership of project risk from the stakeholders and fundamentally altered the project objectives.

Incidentally, Magellan’s pride was his undoing. When his expedition finally set shore in the Philippines after a long and perilous journey across the South Pacific, the locals murdered the unfortunate mariner. Had his forces been stronger in number and less weary from totalitarian command, Magellan’s forces may have been able to save him (Kozak-Holland, 2011).

Pride apparently makes for a dangerous navigator.

Risk Maturity Apex: The Second Panama Canal Attempt

Our next stop in understanding the trend we identified in Figure 5 was to look at the apex of project management risk maturity in our sample of projects. This point was the second Panama Canal project. The story of the Panama Canal is actually a tale of two

separate endeavours. The French initiated the first attempt in the late 1800s. Their project was a catastrophic failure. The Americans undertook the challenge in the early 1900s. Their attempt was an overwhelming success.

The objectives of each attempt were as different as the governments who framed them. The French sought profit. A seaway bridging the Atlantic and Pacific would present tremendous new merchant opportunities. Control of this route would be worth a fortune. The Americans, on the other hand, were less concerned about the commercial aspects of a Canal as they were about their own national security. The United States has two large coasts separated by 3000 miles of land. Naval management of its borders was costly and time-consuming, since resource transportation from coast to coast had to occur over land. A seaway through Panama would give the United States direct maritime access from one coast to another.

The project managers the stakeholders assigned to their respective projects were likewise very different. France’s delegate was a man named Ferdinand de Lesseps. He had previously built the Suez Canal bridging the Red Sea with the Mediterranean and was a favourite for the position. Theodore Roosevelt, then President of the United States, went through multiple project managers until he found George Goethals, who would ultimately lead him to success. Goethals was a military man and could be court-martialed if he abandoned the project. This fact made him an ideal candidate to work against Roosevelt’s steely determination. However, Goethals did not have De Lesseps’ glamorous background. He had managed smaller engineering projects in his career, but nothing as massive and daunting as carving a waterway between two oceans.

Despite their disparate backgrounds, these two project managers took very different approaches to the management of their respective project risks. While not exhaustive, Table 3 presents some of the more serious risks to both Panama Canal attempts and shows the different approaches to risk management each project manager pursued. In general, De Lesseps largely ignored project risk, while Goethals took his risks very seriously (Kendall, 2006).

Table 3. Comparison of Some Risk Strategies in Both Panama Canal Attempts

Risk	French Approach	American Approach
Rains may flood trenches, obliterate digging progress and kill men trapped inside.	Accept the risk. Continue pushing forward, importing new workers to replace those lost.	Avoid the risk. Build substantial infrastructure on the ground before beginning the dig.
Yellow fever and malaria may kill the workforce.	Accept the risk. Continue pushing forward, importing new workers to replace those lost.	Avoid the risk. Eradicate disease on the ground before beginning the dig. Develop mosquito control and disease prevention protocols.
A straight through cut from coast to coast will be too costly and take far longer than a lock-and-dam approach.	Accept the risk. Stick to the original plan. To change the plan would require informing the stakeholders the Canal would not be built as expected.	Avoid the risk. Build the lock-and-dam Canal the engineers advise.

Table 3. Comparison of some risk approaches used in both the French and American Panama Canal attempts. Compiled from data contained in *A tale of two projects: The Panama Canal and the birth of project and risk management* by Tom Kendrick (2006).

The Project Management Institute specifies four different approaches for dealing with project risk. While project managers must measure the efficacy of each approach individually by risk, in general, the four approaches each require different levels of maturity to be able to successfully manage them. Risk acceptance, for example, requires very little maturity. If the project manager chooses this strategy, they do not have to do anything. The project team accepts the risk and deals with whatever consequences may come. Likewise, risk transference requires very little effort on the part of the project team. In this scenario, the project manager hires an insurance company and asks them to own any risk consequences.

Moving down the list of possible approaches, risk mitigation requires that the project manager put active plans in place to deal with consequences that arise. Finally, risk avoidance requires that project plans be permanently altered such that risk consequences do not affect the project. Figure 8 presents these risk strategies in order of the maturity required to implement them.

Figure 8. Maturity Levels Associated With Different Risk Strategies

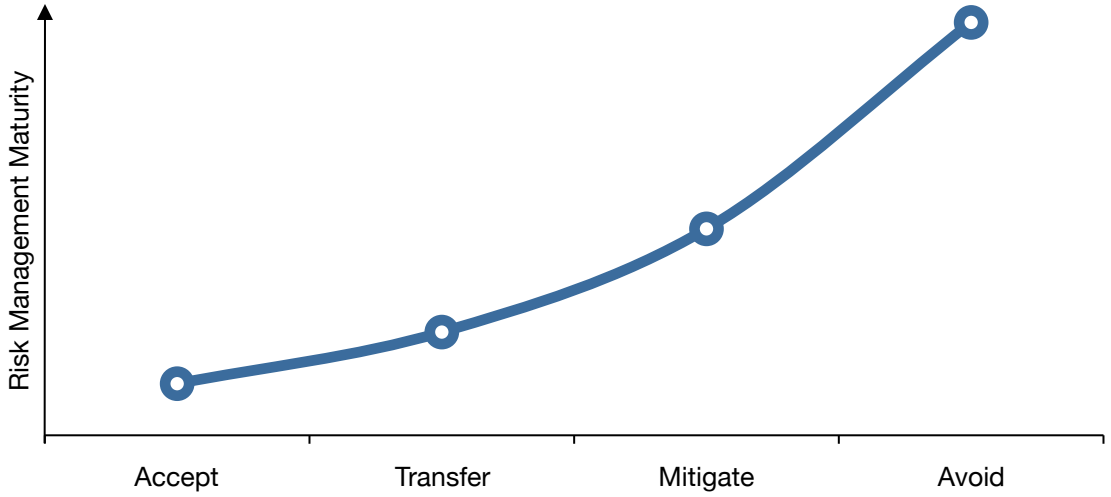

Figure 8. Four different ways of approaching a project risk and the level of maturity required to manage each approach. Built from information contained within *A Guide to the Project Management Body of Knowledge, 4th Edition* by the Project Management Institute (2008).

Comparison between the two Panama Canal projects shows a surprising disparity in risk management maturity. Whereas the French attempt seemed to prefer to accept most serious risks (or not address them at all), the successful American attempt favoured sheer risk avoidance as much as possible. The results were clear. Ferdinand De Lesseps' project cost stakeholders 500 times the initial estimate, did not complete and left an ecological ruin in its wake. Goethals' project cost only 93% of its initial estimate and completed six months ahead of schedule.

While one may wish to applaud Goethals' incredible results and condemn De Lesseps for his lack of risk planning, such conclusions may be premature. A critical examination of the

factors that led up to each set of results may help to understand some of the choices each project manager made and why the project outcomes were so vastly different.

First, De Lesseps had no idea of what awaited him in Panama. While he had previously built the Suez Canal, the geographical environment at the Egyptian work site was flat and dry with marvelous visibility. The Panamanian rainforest was the exact opposite—much of De Lesseps’ previous work in Egypt proved irrelevant in tropical conditions. Goethals, on the other hand, had the benefit of the previous French failure. All of the lessons of “what not to do” were littered across the Central American countryside for anyone who wanted to look. Goethals should rightly be praised for seeking this information, but had this analogue input to his plans been absent, his results may have been very different.

Second, each project’s objectives were unique. The French desire to control maritime trade smacked of opportunism. Stakeholders would have lost nothing if they chose not to pursue the project and had everything to gain. If the Americans did nothing, on the other hand, they risked inadequate naval defense along their borders. Failing to pursue the Panama project could have cost stakeholders their country’s security. The different rationales behind each project may have made the difference between “what a great idea” and “we have to get this right”.

Finally, the two project managers’ relationships with their respective stakeholders differed dramatically. De Lesseps took the money from his investors, but did not keep them informed of his actions. Indeed, a large portion of resources went towards the development of a professionally designed “Canal Bulletin” which was replete with propaganda and sometimes outright lies of project progress (Kendrick, 2006). Goethals, however, had a solid relationship with stakeholder Theodore Roosevelt, who in turn put his considerable weight behind

Goethals’ efforts. The two stayed in as much communication as the technology of the time would allow and Roosevelt shared the burden of project decisions with his project manager.

Speculation on Overall Trend

Although we drew some interesting conclusions from details involved in the high and low points of our analysis, we were still left to wonder. Our project sample spanned almost 4500 years of Human Endeavour. Why did we observe such a clear pattern regarding levels of project risk management maturity?

During our initial juxtaposition of catastrophic world events and our projects, we discounted the Fall of the Roman Empire because our project sample did not contain sufficient data to warrant a correlation. But Rome took several centuries to rise and fall. By the Empire’s end, the level of cultural sophistication was quite high. Following Rome’s eventual ruin, societal structures collapsed and the Church stepped in to fill the void and Europe entered the Dark Ages. Could “sophistication” be a key variable in project risk management?

To understand this, we needed a better definition of sophistication. Looking back over the projects in our sample, we identified four variables that we felt spoke to this concept. We then developed a simple rubric (see Table 4) to establish criteria that helped constitute cultural sophistication.

Table 4. Rubric to Gauge Cultural Sophistication

Factor	Low sophistication	High sophistication
Continuous improvement of existing processes	Processes remain the same even when they don’t work. Practitioners guard their ways of working and make few changes. Alternatively, process awareness is immature.	Processes receive a high amount of input from practitioners. They are frequently altered and refined to become more efficient.
Push for technological advancement	One tool for a job is adequate. People are content to work with the tools at their disposal and do not “wish it were easier”.	Society demands tools that will make their work easier. Businesses arise to meet this demand through research and innovation.
Access to historical records	Historical information is withheld from the population at large. Autocracies or oligarchies keep people in the dark about what has gone before.	Current and historical information is freely available to any who seek it. Democracies encourage people to draw connections between history and current events.
Cultural levels of education	The vast majority of the population has little or no education. There is no funding for, interest in or venue to encourage people to learn.	The vast majority of the population has a considerable amount of education. Society values schooling; places of learning proliferate.

Table 4. A rubric to evaluate the levels of cultural sophistication of a particular era.

With rubric in hand, we roughed out a curve based on our understanding of world history in terms of each of the points above. Beginning in the Bronze Age, when the Giza Pyramid was built, we observed steadily increasing levels of cultural sophistication that culminated with the Roman Empire’s prosperity, repositories of wisdom and technological advancements. These levels plunged at the start of the Early Middle Ages, where vast stores of knowledge were lost to public awareness. For a long time, the Church controlled the written word and libraries were only available to a select few. People learned those things that the Church wanted them to know. Over the next thousand years, cultural levels of sophistication slowly grew again, until, with the invention of the Gutenberg printing press in the 1600s, all four points in our rubric increased exponentially through to the present day. Our

curve was highly speculative, but it gave us a reasonable background against which to plot our data. Figure 9 shows the results of this mapping.

Figure 9. Risk Management Maturity Against Cultural Sophistication

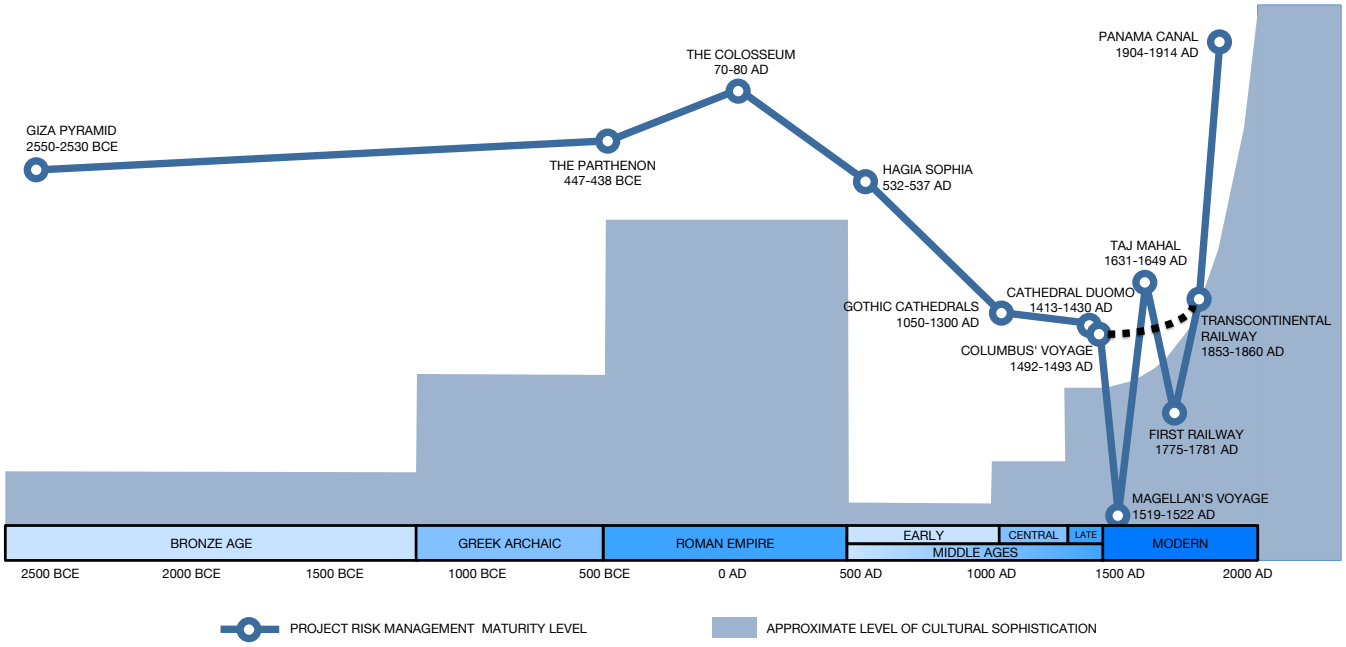

Figure 9. In general, Western civilization has seen two major swells in sophistication. Improvements in technology, access to historical records and societal-level education steadily increased until the fall of the Roman Empire. At this point the West regressed to a more tribal culture that revolved around the Church. Over time, Western sophistication grew again and the growth curve skyrocketed with the introduction of the Gutenberg printing press in the 1600s. Our graph of risk maturity levels appears roughly to correlate with these long-term historical trends.

If the map we drew is reasonably accurate, it presents an interesting picture. There appears to be some rough correlation between levels of cultural sophistication as defined in our rubric above and the levels of risk management maturity that project managers used to govern their projects. There appear to be three anomalies to the curve: Magellan’s Voyage, the Taj Mahal and the First Railway project. In the absence of these three points, our map would line up very well. We have already covered Magellan’s Voyage within this paper; perhaps Magellan’s deplorable leadership practices made the project a significant outlier. The Taj Mahal in India was built apart from Western civilization and should have been unaffected

by Rome’s collapse and the subsequent cultural changes. Risk management details of the First Railway project would make for an interesting follow-up investigation.

Why might cultural sophistication play a role in risk management maturity? To answer this question, we must come back full circle to the fundamentals of project management we covered earlier. Project risk spans multiple domains. In any project, the project team must contain specialists with sufficient knowledge to build their own component parts of the new product for which the project is intended. But having a team in the first place means that the project manager must have access to knowledge of human resources management. Workers and materials cost money and so the project manager will need to understand techniques associated with budgets and accounting. In all, the PMI specifies nine separate knowledge areas. While none are directly related to the construction of a product, their absence may result in the project’s demise. Information does not emerge from a vacuum. Entire professions revolve around these nine knowledge areas, but for them to exist in the first place, the prevailing culture must allow them to thrive.

As teams begin to recruit members with these more tangential skills, Brooks’ theories of communication gain greater relevance. Specialists bring insights with them that other team members could not reasonably possess. All of this new information must flow down the communication channels in the project team and guide the work that each member performs. Brooks is very clear on matters of knowledge. If a team member’s job is only to passively receive information and execute tasks, then their thoughts and opinions are irrelevant to the project (Brooks, 1995). For example, a project to harvest an orchard of its apples requires workers to go out, pick apples and return home. Under optimal conditions they do not need to inform other team members of their experience, since all team members’ experiences

should be identical. If, however, one team member discovers a bear den near the orchard, then he possesses unique knowledge of a risk that could harm the project. If he is not empowered to communicate this information, the risk consequences may ensue. Cultures that suppress information, penalize those who speak of their knowledge or do not provide mature vehicles to encourage collaboration, expose their works to greater risk than cultures that are more progressive.

Conclusions

After extensive examination of the foregoing analysis, we extracted a series of high-level principles that we believe could help project managers today. We believe these conclusions could aid in the application of modern risk management techniques and serve as adjuncts to existing organizational philosophies.

Principle 1: Risk information is worthless if it results in no action.

Ferdinand De Lesseps had a wealth of information available to him during the run of his failed project. However, he chose not to take advantage of this data. Rather than stopping to consider the risks of disease, engineering requirements and the climate on his project’s outcome, he took a very passive approach to managing his risk. Further, when he saw first-hand the results of his decisions (i.e., his men started dying), he had opportunities to prevent further damage. He chose to ignore these costs and continued to pay for more workers to replace those lost. Since the project ultimately failed, the entire body of risk information available to De Lesseps meant nothing.

Principle 2: The last person to change the risk tolerance level through choice or action is the risk owner.

As Magellan was physically at the helm of his expedition, stakeholders entrusted him to protect their interests. When maintaining autocratic control of his operation became more important than safeguarding his crew by managing their fears, Magellan took risk ownership away from the Spanish royalty. This action altered the project’s objectives and very nearly resulted in a catastrophic failure. More importantly from our perspective, a change in risk ownership also results in a change in the motivation behind the project. In this case, Magellan’s motivations overrode those of Spain.

Principle 3: Pride minimizes the perceived likelihood and impact of risk consequences.

Magellan’s pride may have cost his expedition four ships, countless men and his own life. The expression “pride cometh before a fall” is apt, especially when placed under a project management lens. When Magellan executed crew who had the audacity to question his decisions, he presumed his actions were above reproach. By doing so, he dismissed any risks to his expedition that his choices might engender. His was a fatal error. The risks were always there; Magellan chose not to see them.

Principle 4: Desperation makes all risks irrelevant.

Spain’s motivation to send Magellan across the horizon to find a route to Asia was a tremendous undertaking with tremendous risk. However, their economic conditions at the time appeared to demand a wild response. Taking no action in the face of a massive labour and resource shortage could have resulted in stakeholders losing power. In a similar (but much less severe) vein, the risks associated with leaving their naval borders exposed spurred

the United States to attempt to build a seaway through Panama, despite the fact that the French had already failed.

When the status quo becomes a risk in itself, the risk of change becomes less of a problem.

The Risk-Motivation Cycle

After reviewing the above four conclusions, a pattern appeared to emerge that involved the mindset of risk owners on a given project. We observed that different project rationales tended to lead risk owners in a predictable circular pattern, if the risks they took were successful. Organizing the pathways in order of underlying prosperity, we developed the risk-motivation cycle shown in Figure 10. Explanations for each discrete step in the cycle follow, and we suggest theories for risk/reward balance of each step in the subsequent Table 5.

Figure 10. Proposed Risk-Motivation Cycle

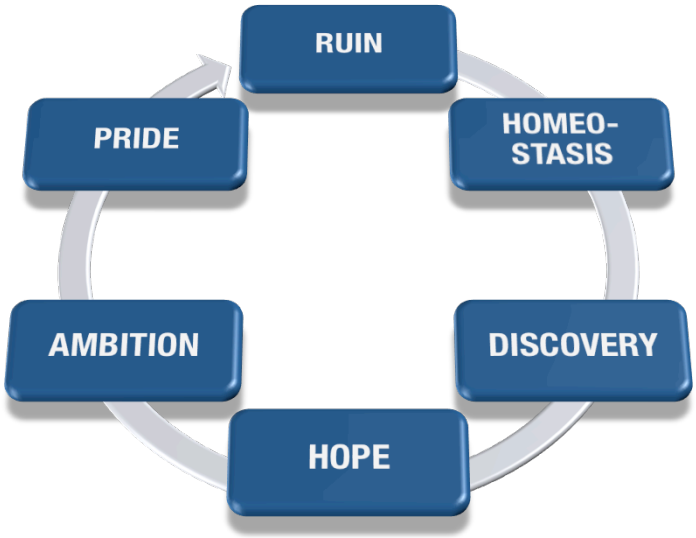

Figure 10. This model demonstrates a cycle of launch points for taking risks. The risk owner's motivations that lie behind their risks predict the state in which the risk owner will find himself if the risk is successful.

Ruin. When a risk owner finds himself in this state, risk versus reward is a meaningless concept. The stakeholder must take any sort of action to get out of a ruined position. At this point there is nothing to lose except life (legal or literal), but life itself is already in jeopardy.

Homeostasis. If a risk owner takes a risk from a ruined state and the gamble is successful, the risk owner will find him- or herself in a position of homeostasis. Their base needs will be met, but fear of regression to ruin will prevent the risk owner from taking further chances that could jeopardize their current position.

Discovery. Eventually, the human drive to achieve will override the fears associated with the homeostatic condition. Mazlow’s Hierarchy of Needs suggests that base survival will not be sufficient for long. As the fear of regression dissipates with time, the risk owner may set his or her sights on new horizons. If their gamble pays off, they may find themselves in a state of discovery.

Hope. Discovery has a direct path to hope. Here, evidence of potential prosperity allows risk and reward to fall into perfect balance. Hope drives people to take moderate chances to gain something new, but does not encourage people to take inappropriate risks. This is an ideal platform from which stakeholders and project managers can run their projects.

Ambition. But our cycle has a dark side. Eventually, an organization’s hard-won success may lay the groundwork for others to rise with more self-serving objectives. While not dangerous in and of itself, ambition puts more emphasis on reaping rewards and less on concerns of failure.

Pride. Finally, a successful risk following ambition can lead to pride, that most deadly of sins. As we have seen, pride causes risk owners to minimize the likelihood and impact of

perceived risks, but the consequences remain. Risks taken from a rationale of pride can ultimately lead an organization all the way back to ruin.

Table 5. Risk Management Properties Within the Proposed Risk-Motivation Cycle

Risk Owner Position	Risk Management Health
RUIN	Unhealthy. Risk tolerance is weighted 100% on the side of reward. Management and mitigation approaches are irrelevant.
HOMEOSTASIS	Unhealthy. Risk tolerance is weighted 100% on the side of risk. Risk owner will be unlikely to move from this state for a while.
DISCOVERY	Healthy. Risk and reward are reasonably balanced, although slightly skewed towards risk aversion. Fears of failure still outweigh hopes of success.
HOPE	Very Healthy. Risk and reward lie in perfect balance. Stakeholders champion moderate risks, but do not recklessly endanger their operation.
AMBITION	Healthy. Risk and reward are reasonably balanced, although reward is preferred. Desire for success outweighs fear of failure.
PRIDE	Unhealthy. Risk tolerance is weighted 100% on the side of reward. Perceived consequences to risk are minimal; actual risk remains.

Table 5. The intersection of process groups and knowledge areas forms the basis for modern project management practices. Cells in the above grid contain a collection of tools and techniques that project managers must master in order to achieve Project Management Professional status from the Project Management Institute.

What we found most interesting in the above model is that the same project, Magellan's voyage, appeared in two different places. Spain, the project's primary stakeholders, may have been in a position somewhere between Discovery and Hope. They needed to find an alternate trade route to Asia. However, when Magellan assumed ownership of the project's risk and ignored the needs of his crew, he changed the project's position in the cycle. As the new risk owner, Magellan shifted the project to a place somewhere between Ambition and Pride. This suggests that modern project managers must be very disciplined and not allow self-interest to steer their projects off course. Key stakeholders should also take

note, and ensure they maintain good lines of communication with their project managers. Failure to do so may result in surprises if their project diverts from its intended goal.

Principle 5: It is not the risk, but rather the objectives behind the risk that predict the outcome.

The above risk-motivation model needs to be validated. However, on consideration of the cycle, we observe that the risks themselves do not appear to predict the outcome of the decision to take a risk in the first place. Rather, according to the model, the best predictor of a successful gamble appears to be the objectives that lie behind the risk. Project managers and stakeholders each need to seriously question and understand their motivations for undertaking a body of work. If they drive their project with a good balance of risk versus reward, they may stand a far better chance of landing in a safe place than if their motivations are weighted too far on one side or the other of the risk/reward line.

A final word about the application of these principles.

Novelist and playwright Jeanette Winterson said, “What you risk reveals what you value”. These words resound in a risk management context. Projects today pose so many difficult choices to their project managers. Pressure from argumentative stakeholders, dwindling budgets, crushing schedules and team member conflicts all conspire to lead a project manager astray. For contemporary project captains to navigate these churning seas of risk, they need to follow their own internal compass. They need to stay true to themselves.

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Appendix A

Qualitative Risk Assessments

Qualitative Risk Assessments

Risk Events 1 – 15: The Giza Pyramid

Egypt, 2550-2530 BCE. Built as a burial chamber for the Pharaoh Khufu, this project relied heavily on analogous estimation techniques and extraordinary precision to prevent the pyramid from collapsing.

Project Name: Giza Pyramid **Qualitative Risk Assessment**

Instructions: Enter each risk event you can identify from the reading. Rate both risk likelihood and impact on a scale of 1 - 4, where 1 is low and 4 is very high. Describe the consequence of each risk. Identify which of the four risk approaches were used to address the risk, and describe the strategy used. Finally, rate the revised risk likelihood and impact on a scale of 1 - 4, and compare the change in risk assessment.

				Score Before Risk Approach						Score After Risk Approach		
Num	**Pages**	**Knowledge Area**	**Risk Event**	**Likelihood**	**Impact**	**Risk Assessment**	**Consequence**	**Approach**	**Strategy**	**Likelihood**	**Impact**	**Risk Assessment**
1	90	Quality Management	Asymmetry prevents completion	4	4	**Ruinous**	Substantial demolition and rework. Cost is greater the nearer to completion.	Mitigate	Ensure near-perfect leveling of foundation. Mark bricks to identify craftsman. Claw back work to correct.	3	4	**Serious**
2	78	Quality Management	Burial chamber collapses	4	4	**Ruinous**	Substantial demolition and rework. Cost is greater the nearer to completion.	Mitigate	Monitor pressure with plaster. Cracks indicate a problem. Claw back work to correct.	3	4	**Serious**
3	71	Schedule Management	Pharaoh dies early	2	4	**Watch**	Pyramid is not completed when needed.	Mitigate	Crash project if pharaoh shows signs of illness.	2	3	**Watch**
4	96	Human Resources Management	Seasonal drought	2	4	**Watch**	Food shortage for workers.	Mitigate	Hire cooks. Stockpile food. Solicit farmers to provide a share to support the project.	2	2	**Watch**
5	73	Procurement Management	Shortage of materials - granite	3	3	**Serious**	Stoppage of work from the quarry onwards.	Avoid	Develop relationships with vendors for each type of material. Ensure a steady stream of new materials, but also maintain a surplus in the event of slowdown. Monitor production rates and adapt all production areas to compensate for an individual shortage or slowdown. Use scribes to track inventories and production rates across the project.	1	3	**Benign**
6	73	Procurement Management	Shortage of materials - limestone	3	3	**Serious**	Stoppage of work from the quarry onwards.	Avoid		1	3	**Benign**
7	73	Procurement Management	Shortage of materials - rope	3	3	**Serious**	Stoppage of work from transport onwards. Storage issues at quarry.	Avoid		1	3	**Benign**
8	73	Procurement Management	Shortage of materials - sleds	3	3	**Serious**	Stoppage of work from transport onwards. Storage issues at quarry.	Avoid		1	3	**Benign**
9	73	Procurement Management	Shortage of materials - tools	3	3	**Serious**	Stoppage of work from the quarry onwards.	Avoid		1	3	**Benign**
10	76	Risk Management	Sledges sink	3	4	**Serious**	Stoppage of work from transport onwards. Storage issues at quarry.	Avoid	Build a canal and harbour through to the construction site. Eliminate need for sledges.	1	1	**Benign**
11	94	Human Resources Management	Worker injury / death - construction	3	2	**Watch**	Slowdown of work.	Mitigate	Injuries and deaths will affect morale in addition to creating work slowdowns. Keep medical staff on hand to address problems; ensure adequate safety precautions. Design transport processes to minimize injuries. Get resource buy-in through promotion and cultural adoption. Develop an effective worker hierarchy and execute discipline at all project levels.	2	2	**Watch**
12	94	Human Resources Management	Worker injury / death - exposure	3	4	**Serious**	Stoppage or serious slowdown of work.	Mitigate		1	2	**Benign**
13	94	Human Resources Management	Worker injury / death - quarry	3	2	**Watch**	Slowdown of work.	Mitigate		2	2	**Watch**
14	94	Human Resources Management	Worker injury / death - transport	3	2	**Watch**	Slowdown of work.	Mitigate		2	2	**Watch**
15	95	Human Resources Management	Worker morale flags	3	3	**Serious**	Stoppage or serious slowdown of work.	Avoid		2	4	**Watch**

Risk Events 16 – 25: The Parthenon

Greece, 447-438 BCE. The military leader Pericles was determined to rebuild his city after the Persian invasion. This temple to Athena incorporates an optical illusion to make the columns appear straight (they are not).

Project Name: The Parthenon **Qualitative Risk Assessment**

Instructions: Enter each risk event you can identify from the reading. Rate both risk likelihood and impact on a scale of 1 - 4, where 1 is low and 4 is very high. Describe the consequence of each risk. Identify which of the four risk approaches were used to address the risk, and describe the strategy used. Finally, rate the revised risk likelihood and impact on a scale of 1 - 4, and compare the change in risk assessment.

				Score Before Risk Approach						Score After Risk Approach		
Num	**Pages**	**Knowledge Area**	**Risk Event**	**Likelihood**	**Impact**	**Risk Assessment**	**Consequence**	**Approach**	**Strategy**	**Likelihood**	**Impact**	**Risk Assessment**
1	105-106	Cost Management	Stakeholders may not approve budget.	3	4	Serious	Project does not begin.	Avoid	Plutarch charged the budget to his personal reserves.	1	1	Benign
2	107	Quality Management	Perfect lines may not appear perfect from a distance.	4	3	Serious	Project would not meet quality standards.	Avoid	Build curvatures in the marble to create the appearance of perfection.	2	3	Watch
3	109	Quality Management	Adjacent blocks may not fit together.	4	4	Ruinous	Project would not meet quality standards, finished building may have structural issues.	Mitigate	Use the Panograph to record variances, and sand accordingly.	2	4	Watch
4	121	Risk Management	Earthquakes.	4	4	Ruinous	Finished product would be destroyed.	Mitigate	Build the Parthenon on both bedrock and stone bedding.	2	4	Watch
5	116	Human Resources Management	Shortage of materials.	3	3	Serious	Stoppage of work and storage issues.	Avoid	Manage supply teams with just-in-time strategies.	1	3	Benign
6	118	Quality Management	Lack of measurement standards between masons.	4	4	Ruinous	Individual components would not come close to fitting correctly.	Avoid	Implement the Salamis Stone to align disparate measurement standards.	2	4	Watch
7	120	Risk Management	Project team lacks a common vocabulary.	2	3	Watch	Individual components may have fit problems.	Mitigate	Provide templates and full scale models to communicate ideas.	1	3	Benign
8	120	Risk Management	Structural failure.	4	4	Ruinous	Parthenon collapses.	Mitigate	Use massive drums in the columns. Track stone sources to identify defects.	2	4	Watch
9	120	Risk Management	Marble damaged in transit.	4	3	Serious	Finished product looks shoddy.	Mitigate	Transport oversized marble and refine at the project site.	2	4	Watch
10	120	Risk Management	Parts of substructure are higher than natural ground.	4	4	Ruinous	Parthenon collapses.	Avoid	Redesign Parthenon dimensions to reduce pressure on these parts.	2	4	Watch

Risk Events 26 – 35: The Colosseum

Italy, 70-80 AD. In the aftermath Nero’s cruel and despotic rule, Emperor Vespasian needed to prevent a civil uprising. He sponsored this games palace as a gift to his people.

Project Name: The Colosseum **Qualitative Risk Assessment**

Instructions: Enter each risk event you can identify from the reading. Rate both risk likelihood and impact on a scale of 1 - 4, where 1 is low and 4 is very high. Describe the consequence of each risk. Identify which of the four risk approaches were used to address the risk, and describe the strategy used. Finally, rate the revised risk likelihood and impact on a scale of 1 - 4, and compare the change in risk assessment.

				Score Before Risk Approach						Score After Risk Approach		
Num	**Pages**	**Knowledge Area**	**Risk Event**	**Likelihood**	**Impact**	**Risk Assessment**	**Consequence**	**Approach**	**Strategy**	**Likelihood**	**Impact**	**Risk Assessment**
1	135	Communications Management	The public may rebel against this regime after a bad experience with Nero.	4	4	Ruinous	Project may have to be abandoned.	Avoid	Build project with public as stakeholders. Provide impeccable communication.	2	4	Watch
2	139	Risk Management	Storm deluge of 175 litres of water per second.	4	4	Ruinous	Structure would be ruined.	Mitigate	Build complex drainage network.	4	1	Watch
3	162	Schedule Management	Chief sponsor is aging, and may die before completion.	3	3	Serious	Sponsor will be disappointed and may reduce support.	Avoid	Crash or fast track where possible. Leverage standards in all aspects of design and execution.	2	3	Watch
4	163	Cost Management	Costly materials required for aesthetics require considerable shipping time.	3	3	Serious	Project may be delayed.	Mitigate	Use such materials in the form of a veneer, order them in parallel with core construction.	3	2	Watch
5	164	Quality Management	Keystones (Voussoirs) for the arches may not fit.	3	4	Serious	Structure may collapse.	Avoid	Ensure high degree of accuracy through strict quality control.	1	4	Watch
6	166	Communications Management	Public may take the project for granted or lose interest.	2	3	Watch	Active participation may wane.	Mitigate	Mint coins stamped with an image of the finished colosseum to remind citizens every day.	1	3	Benign
7	166	Risk Management	Project risks may defeat the project.	4	4	Ruinous	Any number of unforeseen consequences could kill the project.	Mitigate	Develop specific risk plans to prevent dangers.	2	2	Watch
8	167	Risk Management	The public may be injured during entry and exit with the volume of crowds.	3	4	Serious	A public relations disaster for the colosseum overseers.	Avoid	Design large paths, archways and seating to accommodate a flow of up to 50,000 people.	2	3	Watch
9	167	Risk Management	Concrete is a new material and its use in a large project is uncertain.	2	4	Watch	Structure may collapse if concrete proves inadequate.	Mitigate	Combine concrete with stone, which is a tried and tested material. Use limestone in supports.	1	2	Benign
10	168	Procurement Management	Architect’s scope may be unclear	3	3	Serious	Architect’s may not deliver precisely what the project needs.	Avoid	Specify architect’s plans as principal deliverables in the contract.	1	2	Benign

Risk Events 36 – 45: Hagia Sophia

Turkey, 532-537 AD. The collapse of the Roman empire drove Emperor Justinian to attempt to rebuild from his seat in Constantinople. This cathedral was to be greater than any other that had gone before.

Project Name: Hagia Sophia **Qualitative Risk Assessment**

Instructions: Enter each risk event you can identify from the reading. Rate both risk likelihood and impact on a scale of 1 - 4, where 1 is low and 4 is very high. Describe the consequence of each risk. Identify which of the four risk approaches were used to address the risk, and describe the strategy used. Finally, rate the revised risk likelihood and impact on a scale of 1 - 4, and compare the change in risk assessment.

				Score Before Risk Approach						Score After Risk Approach		
Num	**Pages**	**Knowledge Area**	**Risk Event**	**Likelihood**	**Impact**	**Risk Assessment**	**Consequence**	**Approach**	**Strategy**	**Likelihood**	**Impact**	**Risk Assessment**
1	178	Integration Management	Primary stakeholder heavily involved in day-to-day project decisions.	4	3	**Serious**	Stakeholder may make significant changes to project scope on a whim.	Mitigate	Implement strict change control processes.	4	2	**Watch**
2	178	Human Resources Management	Timeline is extremely aggressive (5 years).	4	3	**Serious**	Project may not meet its delivery date.	Mitigate	Hire the very best known architects and arrange for a massive workforce.	4	2	**Watch**
3	179	Risk Management	Architecture was extremely ambitious, untested and new.	4	3	**Serious**	Structure may collapse due to unforeseen design flaws.	Mitigate	Build the cathedral with pumice stone and Rhodian bricks which are very lightweight (reducing material requirement), can float (reducing transport time) and can be more easily dismantled (reducing construction risk).	3	3	**Serious**
4	181	Risk Management	It may take too much time to source the materials required for construction.	3	3	**Serious**	Project may not meet its delivery date.	Mitigate		2	3	**Watch**
5	181	Risk Management	Transporting bricks overland may take too much time	3	3	**Serious**	Project may not meet its delivery date.	Mitigate		2	3	**Watch**
6	180	Human Resources Management	Large workforce must work in a confined environment.	4	2	**Watch**	Work may slow due to traffic problems.	Mitigate	Organize workforce into a hierarchy and plan communications.	2	2	**Watch**
7	191	Risk Management	Earthquakes may destroy the cathedral.	4	4	**Ruinous**	Structure would be destroyed.	Mitigate	Use an earthquake-resistant cement that could reform as cracks appeared. Use lightweight, flexible materials. Use light Rhodian hollowed bricks made from lightweight clay. Use crushed brick in the mortar to add tensile strength. Add 40 windows into the dome to avoid cracking. Use thick mortar joints, thicker than the bricks themselves. Create shock absorbers using lead at the foundation of major columns carrying the dome.	2	4	**Watch**
8	181	Risk Management	Fire may destroy the cathedral.	4	4	**Ruinous**	Structure would be destroyed.	Avoid	Don't use any wood in construction.	1	1	**Benign**
9	190	Risk Management	Elevating bricks to upper reaches of structure is problematic.	4	2	**Watch**	Structure may not complete on time.	Avoid	Build spiral ramps to allow workforce to carry materials to top, and disassemble.	1	2	**Benign**
10	192	Procurement Management	Materials may run in short supply.	3	3	**Serious**	Structure may not complete on time.	Mitigate	Ensure appropriate priority set on maintaining supply chain.	2	3	**Watch**

Risk Events 46 – 52: Gothic Cathedrals

Across Europe, 1050 - 1300 AD. The Dark Ages settled fully across the continent. Some of these projects took over a century to complete due to resource shortages. Guilds and good governance kept them going.

Project Name: Gothic Cathedrals **Qualitative Risk Assessment**

Instructions: Enter each risk event you can identify from the reading. Rate both risk likelihood and impact on a scale of 1 - 4, where 1 is low and 4 is very high. Describe the consequence of each risk. Identify which of the four risk approaches were used to address the risk, and describe the strategy used. Finally, rate the revised risk likelihood and impact on a scale of 1 - 4, and compare the change in risk assessment.

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Num	**Pages**	**Knowledge Area**	**Risk Event**	**Likelihood**	**Impact**	**Risk Assessment**	**Consequence**	**Approach**	**Strategy**	**Likelihood**	**Impact**	**Risk Assessment**
1	225	Integration Management	Long project time spans may result in handovers from multiple stakeholders.	4	3	Serious	Massive opportunity for unplanned change.	Mitigate	Install a multigenerational governance framework.	4	2	Watch
2	225	Integration Management	Crosspoints with multiple trade streams may result in necessary changes.	4	3	Serious	Massive opportunity for unplanned change.	Mitigate	Implement a rigorous change control procedure for each trade.	4	2	Watch
3	225	Integration Management	Slowdown of funding may result in massive loss of workers.	4	2	Watch	Work stoppage.	Accept	Embrace the long turnaround times of the project, and accept that work will periodically stop and resume again.	4	2	Watch
4	227	Time Management	Activities must be sequenced over huge, protracted periods.	3	3	Serious	Significant amounts of rework.	Mitigate	Plan erection sequence well in advance, in fine detail. Stick to the plan.	2	2	Watch
5	228	Cost Management	The massive costs associated with each program need substantial community involvement.	4	3	Serious	Labour shortage in the face of low interest.	Avoid	Create stained glass windows that advertised the project and spurred community interest.	2	3	Watch
6	230	Quality Management	Over time, cathedrals grew significantly in height, and used more glass and less stone.	4	4	Ruinous	New cathedrals could completely collapse.	Avoid	Develop the flying buttress to support walls, and build them with fine accuracy.	4	2	Watch
7	234	Risk Management	Competition between projects spurred chances. Also, architecture was done by trial and error.	4	4	Ruinous	New cathedrals could completely collapse.	Accept	Beauvais Cathedral collapsed, sadly.	4	4	Ruinous

Risk Events 53 – 60: Cathedral Duomo

Italy, 1413-1430 AD. The re-emergence of organized financial institutions drove the wealthy city of Florence to publicly demonstrate its prestige.

Project Name: Florence Cathedral Duomo **Qualitative Risk Assessment**

Instructions: Enter each risk event you can identify from the reading. Rate both risk likelihood and impact on a scale of 1 - 4, where 1 is low and 4 is very high. Describe the consequence of each risk. Identify which of the four risk approaches were used to address the risk, and describe the strategy used. Finally, rate the revised risk likelihood and impact on a scale of 1 - 4, and compare the change in risk assessment.

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1	260	Integration Management	Project stakeholders were highly suspect of the project feasibility.	4	4	Ruinous	Stakeholder conflicts may delay the project.	Mitigate	Go to great lengths to plan and plot against the stakeholders.	2	4	Watch
2	260	Integration Management	Weight of the dome may exceed cost and schedule availability.	4	3	Serious	Cost and time may overrun.	Mitigate	Invoke change control. Reduce the weight of the dome.	2	3	Watch
3	261	Scope Management	Scaffolding required for a single dome vault may increase construction challenge.	3	3	Serious	Cost and time may overrun.	Avoid	Increase dome scope by going with a double vault, but thereby reduce scaffolding scope.	2	3	Watch
4	261	Time Management	Break in supply chain may delay delivery.	3	3	Serious	Schedule may overrun.	Avoid	Spend extra time sequencing activities to ensure supply chain of brick continuously feeds laying.	2	3	Watch
5	262	Cost Management	Unauthorized leave may hamper the schedule.	2	3	Watch	Schedule may overrun.	Mitigate	Automatically dismiss workers who take unauthorized leave.	1	3	Benign
6	262	Cost Management	Travel up and down the scaffolding for meals could slow progress.	3	3	Serious	Schedule may overrun.	Mitigate	Open kitchens at the dome level. Extend the workday.	1	3	Benign
7	264	Quality Management	Curvature of rising brick walls could collapse the structure if done improperly.	4	4	Ruinous	Walls could distort and structure could collapse.	Avoid	Check constantly.	2	4	Watch
8	264	Human Resource Management	Disease may obliterate workforce.	1	4	Watch	Project would grind to a halt.	Accept	Unfortunately the Black Death did wipe out the workforce.	4	4	Ruinous

Risk Events 61 – 68: Columbus’ Voyage

Spain, 1492-1493 AD. The fall of Constantinople demanded new Asian trade routes. Portugal already dominated the route to Asia by way of Africa.

Project Name: Columbus' Voyage to the Americas **Qualitative Risk Assessment**

Instructions: Enter each risk event you can identify from the reading. Rate both risk likelihood and impact on a scale of 1 - 4, where 1 is low and 4 is very high. Describe the consequence of each risk. Identify which of the four risk approaches were used to address the risk, and describe the strategy used. Finally, rate the revised risk likelihood and impact on a scale of 1 - 4, and compare the change in risk assessment.

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Num	**Pages**	**Knowledge Area**	**Risk Event**	**Likelihood**	**Impact**	**Risk Assessment**	**Consequence**	**Approach**	**Strategy**	**Likelihood**	**Impact**	**Risk Assessment**
1	292	Risk Management	Nobody knows what lies beyond the horizon. It could be anything.	4	4	Ruinous	Expedition could be lost.	Accept	Let them go but give them three ships. One might return.	3	4	Serious
2	293	Time Management	Ships held a finite amount of supplies.	4	4	Ruinous	Failure to return on time could kill the expedition through starvation.	Mitigate	Make painstaking distance measurements throughout the project.	4	3	Serious
3	294	Quality Management	Food could spoil.	3	4	Serious	The crew could starve.	Mitigate	Bring a cooper on the voyage to check the condition of the food barrels.	2	4	Watch
4	294	Quality Management	Ships could steer off course	3	4	Serious	Expedition could be lost.	Mitigate	Perform dead reckoning at every opportunity.	2	4	Watch
5	296	Human Resources Management	Crew could mutiny.	3	4	Serious	Expedition could be lost.	Mitigate	Careful manage the moods of the crewmen, and show appropriate empathy as required.	2	4	Watch
6	292	Scope Management	Superstition could prevent Columbus from forming a crew.	4	1	Watch	Expedition will never leave.	Mitigate	Negotiate, sell and beg if necessary.	3	1	Benign
7	294	Quality Management	Leaky or worn ships could sink.	3	4	Serious	Expedition could be lost.	Mitigate	Check ships' seaworthiness constantly.	2	4	Watch
8	296	Communications Management	Failure to communicate could result in separation of the ships.	3	4	Serious	Expedition could be lost.	Mitigate	Keep visual ship-to-ship communications open and active at all times.	2	4	Watch

Risk Events 69 – 77: Magellan’s Voyage

Spain, 1519-1522 AD. It didn’t take long to figure out that Columbus’ landing wasn’t Asia. Spain still needed to beat the Portuguese and find a way around the globe.

Project Name: Magellan's Voyage Round the World **Qualitative Risk Assessment**

Instructions: Enter each risk event you can identify from the reading. Rate both risk likelihood and impact on a scale of 1 - 4, where 1 is low and 4 is very high. Describe the consequence of each risk. Identify which of the four risk approaches were used to address the risk, and describe the strategy used. Finally, rate the revised risk likelihood and impact on a scale of 1 - 4, and compare the change in risk assessment.

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1	319	Risk Management	Nobody knows what lies beyond the horizon. It could be anything.	4	4	Ruinous	Expedition could be lost.	Accept	Let them go but give them five ships. One might return.	3	4	Serious
2	320	Scope Management	Pacific Ocean distance estimates were unknown.	4	4	Ruinous	Expedition could starve.	Accept	Go anyway; take the chance.	4	4	Ruinous
3	320	Time Management	Ships held a finite amount of supplies.	4	4	Ruinous	Failure to return on time could kill the expedition through starvation.	Mitigate	Make painstaking distance measurements throughout the project.	4	3	Serious
4	321	Human Resources Management	Crew could mutiny.	3	4	Serious	Expedition could be lost.	Accept	Insufficient planning. Crew did mutiny.	4	4	Ruinous
5	322	Quality Management	Leaky or worn ships could sink.	3	4	Serious	Expedition could be lost.	Mitigate	Check ships' seaworthiness constantly.	2	4	Watch
6	322	Communications Management	Failure to communicate could result in separation of the ships.	3	4	Serious	Expedition could be lost.	Accept	Insufficient planning. One ship abandoned the expedition.	3	4	Serious
7	322	Quality Management	Inadequate provisions could lead to scurvy.	3	4	Serious	Expedition could become seriously ill.	Accept	Insufficient planning. The crew suffered.	3	4	Serious
8	323	Quality Management	Food could spoil.	3	4	Serious	The crew could starve.	Mitigate	Bring a cooper on the voyage to check the condition of the food barrels.	2	4	Watch
9	324	Risk Management	Magellan did not know the location of the path to the Pacific.	3	4	Serious	The crew could mutiny.	Accept	Insufficient planning. Crew did mutiny.	4	4	Ruinous

Risk Events 78 – 83: The Taj Mahal

India, 1631-1649 AD. The fifth great Mughal Emperor Shah Jehan was one of the wealthiest men in the world at this time. This construction was to be his mausoleum.

Project Name: The Taj Mahal **Qualitative Risk Assessment**

Instructions: Enter each risk event you can identify from the reading. Rate both risk likelihood and impact on a scale of 1 - 4, where 1 is low and 4 is very high. Describe the consequence of each risk. Identify which of the four risk approaches were used to address the risk, and describe the strategy used. Finally, rate the revised risk likelihood and impact on a scale of 1 - 4, and compare the change in risk assessment.

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1	333	Integration Management	Construction may not complete during emperor's lifetime.	3	4	**Serious**	Project would not meet its objectives.	Mitigate	Crash or fast track the project as appropriate.	2	4	**Watch**
2	353	Time Management	Break in supply chain may delay delivery.	3	3	**Serious**	Schedule may overrun.	Avoid	Spend extra time sequencing activities to ensure supply chain of brick continuously feeds laying.	2	3	**Watch**
3	353	Cost Management	Costly materials required for aesthetics require considerable shipping time.	3	3	**Serious**	Project may be delayed.	Mitigate	Use such materials in the form of a veneer, order them in parallel with core construction.	3	2	**Watch**
4	354	Quality Management	Earthquakes could topple the structure.	4	4	**Ruinous**	Structure would be destroyed.	Mitigate	Design minarets to lean outwards.	3	4	**Serious**
5	355	Communications Management	International workforce introduces language barriers.	3	4	**Serious**	Project could be delayed.	Accept	Text doesn't cover this but suggests this was not a problem.	3	1	**Benign**
6	355	Risk Management	Proximity to river could damage the foundation.	4	4	**Ruinous**	Structure would be destroyed.	Mitigate	Bore a series of wells around the structure to protect the foundation.	3	4	**Serious**

Risk Events 84 – 90: The First Railway

United Kingdom, 1775-1781 AD. Lack of good roads made the distribution of coal from one of the richest mines in England extremely costly. The mine nearly closed, but new technology meant new possibilities for transport...if they could make it work.

Project Name: First Railway **Qualitative Risk Assessment**

Instructions: Enter each risk event you can identify from the reading. Rate both risk likelihood and impact on a scale of 1 - 4, where 1 is low and 4 is very high. Describe the consequence of each risk. Identify which of the four risk approaches were used to address the risk, and describe the strategy used. Finally, rate the revised risk likelihood and impact on a scale of 1 - 4, and compare the change in risk assessment.

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1	390	Integration Management	Business case uncertain	4	3	**Serious**	Return on investment unpredictable; stakeholders may be dissatisfied	Mitigate	Change business model midstream	4	3	**Serious**
2	392	Time Management	Time constraints are high; as is business pressure and competition	4	3	**Serious**	Second place will not win new business opportunities	Avoid	Crash or fast track as appropriate	4	3	**Serious**
3	393	Cost Management	Required technology is immature	3	3	**Serious**	Substantial extra investment for unknown return	Accept	Make the investment	3	3	**Serious**
4	393	Quality Management	Poor quality could cause trains to derail	4	4	**Ruinous**	Trains could derail	Avoid	Control quality tightly in the foundry	3	4	**Serious**
5	394	Communication Management	Lack of public interest	3	3	**Serious**	New business ventures could be too slow to recoup costs	Mitigate	Open the railway with much fanfare	2	2	**Watch**
6	395	Risk Management	Cost overruns were double what was expected	3	4	**Serious**	Project may have to be abandoned	Accept	Sponsor paid	3	4	**Serious**
7	395	Risk Management	Incorrect technology selection	4	4	**Ruinous**	Project may have to be abandoned	Mitigate	Take extra care in technology selection	3	3	**Serious**

Risk Events 91 – 99: Transcontinental Railway

USA, 1853-1860 AD. The Civil War taught the Presidency that a large country requires the ability to move troops and resources vast distances. Once deemed impossible, the speed with which track was laid astonished everyone.

Project Name: Transcontinental Railway **Qualitative Risk Assessment**

Instructions: Enter each risk event you can identify from the reading. Rate both risk likelihood and impact on a scale of 1 - 4, where 1 is low and 4 is very high. Describe the consequence of each risk. Identify which of the four risk approaches were used to address the risk, and describe the strategy used. Finally, rate the revised risk likelihood and impact on a scale of 1 - 4, and compare the change in risk assessment.

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Num	**Pages**	**Knowledge Area**	**Risk Event**	**Likelihood**	**Impact**	**Risk Assessment**	**Consequence**	**Approach**	**Strategy**	**Likelihood**	**Impact**	**Risk Assessment**
1	434	Integration Management	The project requires massive quantities of materials	4	4	Ruinous	Planning mistakes could be disastrous	Mitigate	Spend substantial time in careful planning	3	4	Serious
2	434	Integration Management	Public and stakeholder confidence was abysmally low	4	4	Ruinous	Sponsors could withdraw funding	Mitigate	Arrange for bond issues, land grants and other incentives	3	4	Serious
3	437	Time Management	The timeline on completing the railway was too long	3	4	Serious	Sponsors could withdraw funding	Avoid	Focus on getting the railroad operational first and improve it later	2	2	Watch
4	437	Time Management	Seasons could have a significant impact on progress	3	3	Serious	Project could stall	Accept	Redeploy workers during winter months	3	3	Serious
5	438	Cost Management	The Civil War disrupted progress	4	4	Ruinous	Public confidence could shatter and workers abandon the project	Accept	War was unexpected, unfortunately it happened	4	4	Ruinous
6	439	Quality Management	Train tracks require a high level of precision	4	4	Ruinous	Trains could derail once operational	Avoid	Insist on a high level of quality in the factories; perform inspections	4	2	Watch
7	441	Human Resources Management	Workers are expensive and demanding pay up front	3	3	Serious	Project could stall or go overbudget early	Mitigate	Arrange for large pools of cheap, "expendable" Chinese workers	2	2	Watch
8	442	Risk Management	Generally speaking, risks are enormous	4	4	Ruinous	Sponsors could withdraw funding and abandon the project	Transfer	Spur incentivized competition between competing railways and share risk	3	3	Serious
9	443	Risk Management	Materials take six months to arrive	3	3	Serious	Project could stall	Mitigate	Plan supply chain well in advance	3	2	Watch

Risk Events 100 – 103: The Panama Canal

USA, 1904-1914 AD. This second attempt sponsored by Theodore Roosevelt allowed the United States better naval management of both its shores.

Project Name: Panama Canal **Qualitative Risk Assessment**

Instructions: Enter each risk event you can identify from the reading. Rate both risk likelihood and impact on a scale of 1 - 4, where 1 is low and 4 is very high. Describe the consequence of each risk. Identify which of the four risk approaches were used to address the risk, and describe the strategy used. Finally, rate the revised risk likelihood and impact on a scale of 1 - 4, and compare the change in risk assessment.

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1	483	Integration Management	The French project was an unmitigated disaster	4	4	Ruinous	A repeat would be another catastrophe	Avoid	Change the approach radically	2	3	Watch
2	484	Scope Management	Workforce requires on-site resources to terraform	4	3	Serious	Without it the project cannot proceed	Avoid	Build a lake; take terraforming in manageable steps	3	2	Watch
3	486	Human Resource Management	Workers are very likely to die due to the harsh conditions	4	4	Ruinous	Project would be too costly to complete	Avoid	Focus on resources to look after the workers first. Build infrastructure Implement sanitation programs Implement mosquito control programs Focus on eliminating on-site threats prior to site development	2	2	Watch
4	488	Risk Management	Landslides could threaten the project	4	4	Ruinous	Substantial destruction of life and property	Avoid	Build a lock and dam structure	3	2	Watch